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**Task 3**

**Smart Grid - Sustainability at Work**

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**A smart grid** is an electrical grid that uses computers and other technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

Smart Grid

● It involve the overlaying of a network metering system over existing

electrical grid. Included in this network metering system are a range of

smart devices including smart meters.

● New generation meters, relays and circuit breakers provide the

measurement and control and allow two way communication to

electricity production, transmission, distribution and consumption

**Smart Grid**

<http://en.wikipedia.org/wiki/Smart_grid>

**Theory**

Research the PowerUSB Controlled Power Board at:

<http://www.pwrusb.com/featuresandbenefits.html>

Check and advise the following:

Voltage Rating: 250 V AC

Total Current Rating: MAX 10A Surge 3500A

Single Outlet Current Rating: 15A

Individual Outlet Fuse: 10A

Power Cable Length: 1.5m

USB Cable Length: 1.5m

Answer the following questions:

Q: Does the PowerUSB comply with Electrical Safety Standards?

A: No. It is not described as being compliant with Australian standard specifications AS/NZ3197

Q: How is the equipment turned on and off?

A: 1 states it’s always on via a switch. 2 & 3 are controlled by USB Power/Software. 4 is able to come on when needed.

Q: How many pieces of computer peripheral equipment can connect to the PowerUSB?

A: 4

Q: What is the procedure for a piece of equipment such as fax machine that needs to be on standby or not to be switched off?

A: Socket 1 is always in use.

Q: What are the features for controlling a printer?

A: 4 uses an auto power on feature so it only turns on when needed.

Q: What are the software features for controlling power outlets?

A: Customizable programmable hot-keys.

Q: What are some other applications of the PowerUSB?

A: The powerUSB is programmable.

**Practicum**

Install the programmable PowerUSB power board software on a PC

Step 1: Obtain the CD or download the software from:

http://smartgridresources.wikispaces.com/

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<http://smartgridresources.wikispaces.com/>

Step 2:

START APPLICATION

Run the Software by double clicking the PowerUSB icon



or from the Windows Start menu under Power USB group



Step 3:

SOFTWARE INTERFACE



The outlets can be powered on by selecting the check box for “Power Outlet 1” and “Power Outlet 2”.

The outlets can also be toggled (‘on’ to ‘off’ or vice versa) by shortcut keys. The shortcut keys for switching on/off (toggle) outlet 1 and 2 are:

Outlet 1: Simultaneously pressing Control – Shift and P key

Outlet 2: Simultaneously pressing Control – Shift and A key.

These shortcut keys will work even when the application is minimized and running in the background

Step 4:

ADVANCED OPTIONS

Clicking the Advanced button will open the Advanced Options dialog.



The Outlet1 and 2 Default state will set the default state of the outlets when connected to a computer (even without the PowerUSB control software running). When set to ‘On’, the outlets will turn ‘on’ when connected to computer and turn ‘off’ when disconnected from computer.

Step 5:

EXITING THE APPLICATION

The application can be exited (quit) only from the system tray. When minimized it will be running in the background in system tray. Right click on the leaf in the system tray and select Exit. **Once quit, the power outlets will be in the previous state**.

Step 6:

**CONNECTING DEVICES - WARNING**

Connect devices such as a monitor, printer, scanner, active speakers and lamp into the 2 outlets marked 'Port 1' and 'Port 2' on the power board **when the PowerUSB complies with Electrical Safety Standards**.

Step 7:

CONTROLLING FROM THIRD PARTY APPLICATIONS

The PowerUSB can be controlled from third party applications through functions calls provided in the DLL.

The DLL provides functions to initialize the PowerUSB and set the outlet power states. The DLL can be loaded statically or dynamically from the calling application.

The DLLs have been tested under Visual Studio .Net and VC++ 6.0 in Windows XP and Windows 7 environments.

*Initialization*

Initializes the Power USB API.

No other functions can be called till the API is initialized.

Name: InitPowerUSB

Parameters: None

Return: >=0 if successful. < 0 on failure

C++ Example:

if (!m\_pwrUSBInit)

{

if (InitPowerUSB() >= 0)

{

m\_pwrUSBInit = 1;

m\_pwrUsbConnected = CheckStatusPowereUSB();

}

}

*Check PowerUSB connectivity*

Checks to see if the power USB is connected to the computer. Returns the number of Power USBs connected.

Windows function OnDeviceChange can be used to monitor the connection/disconnection of the powerUSB dynamically.

Name: CheckStatusPowereUSB

Parameters: None

Returns: Number of PowerUSB devices connected

C++ Example:

BOOL CPowerUSBDlg::OnDeviceChange(UINT nEventType, DWORD\_PTR dwData)

{

m\_pwrUsbConnected = CheckStatusPowereUSB();

UpdateData(TRUE);

if (m\_pwrUsbConnected)

m\_connectionStr = "PwrUSB Connected";

else

m\_connectionStr = "PwrUSB Not Connected";

UpdateData(FALSE);

return TRUE;

}

*Close the Device*

Closes the PowerUSB API. Should be called in application exit function such as OnDestroy.

Name: ClosePowerUSB

Parameters: None

Returns: >=0 if successful. < 0 on failure

C++ Example:

if (m\_pwrUSBInit)

{

ClosePowerUSB();

m\_pwrUSBInit = 0;

}

*Set the Outlet State*

Sets the power on/off state of the two outlets.

Name: SetPortPowerUSB

Parameters: int port1, int port2. (0=switch off the power, 1=switch on the power)

Returns: >=0 if successful. < 0 on failure

C++ Example:

m\_port1 = 0;

m\_port2 = 1;

SetPortPowerUSB(m\_port1, m\_port2);

*Set the Default power up state*

Sets the default power up state of the Power USB (when connected to Computer). If set to 1, the outlet will come on when the attached computer is booted up.

Name: SetDefaultStatePowerUSB

Parameters: int port1, int port2. (0=default off state, 1=default on state)

Returns: >=0 if successful. < 0 on failure

C++ Example:

SetDefaultStatePowerUSB(m\_defaultState1,.m\_defaultState2);

Step 8

TESTING APPLICATIONS

Test the applications.

Tick if applications are successful:

Initialization □

Check PowerUSB connectivity □

Close the Device □

Set the Outlet State □

Set the Default power up state □

**Summary**

The ability to control the power in outlets through provided software also makes the PowerUSB a home or commercial automation device.

Questions

1: Explain how lights or any devices can be switched ‘on’ remotely or through timed software applications using this device: Technology which is now available enables you to remotely control their homes power systems. Some of the things you would do with this technology is turn light switches, power outlets & even your homes water heater all remotely. In some cases you may even be able to set up a timer so it will only be on when need be.

2: Explain how the PowerUSB-C detects and restores computers automatically when they 'hang up': The PC continually sends a service pulse to the controller in the power board. If the board no longer detects this pulse it can initiate a system reset.

Resources

Components - PowerUSB Controlled Power Board

<http://www.pwrusb.com/products.html>

Research USB controlled power outlets at:

<http://www.google.com.au/#hl=en&q=usb+controlled+power+outlet&revid=1332163496&sa=X&ei=6M9oTceyCsejcZ_yiI8M&ved=0CIUBENUCKAY&fp=190c8307a70ec87c>